SYSTEMS FOR MONITORING AND CONTROLLING OPERATING MODES IN AN ETHERNET TRANSCEIVER AND METHODS OF OPERATING THE SAME

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AN ETHERNET TRANSCEIVER AND METHODS OF OPERATING THE SAME

TECHNICAL FIELD OF THE INVENTION

The present invention is directed generally to communications

5   networks and, more particularly, to systems for monitoring and

controlling operating modes in a network transceiver and to methods

of operating the same.

BACKGROUND OF THE INVENTION

The commercial availability of more efficient, reliable and

10   cost effective computer systems and communication networks has

enabled businesses and individuals to rely on the same, and related

peripheral devices, to meet their information and processing needs.

The immeasurable gains in technology experienced by the

computer and communication industries have enabled these computers

15   and communication devices to be standardly equipped with

interchangeable and replaceable parts and devices.

Interchangeability is typically facilitated through expansion

slots, couplable interfaces or the like.

Conventional network communications employ various

20   communications protocols that enable cooperative communication at

each networked computer system. Standards bodies, such as the

Institute of Electronic and Electrical Engineers ("IEEE"), establish standardized communication protocols to facilitate communication over such communication networks. Since standardized protocols maintain different communication platforms, equipment manufacturers must provide support for connection using many, and theoretically all, communications protocols.

A problem arises however when an equipment manufacturer develops and distributes large quantities of non-standardized communication products and devices into a substantially standardized components market. There exists in such a scenario a need to facilitate compatibility with this established communications and processing base, and thus to enable the operating modes of communication devices to be extendable to both industry-compliant and custom modes to achieve increased connectivity and compatibility than would otherwise be possible.

SUMMARY OF THE INVENTION

To address the above-discussed deficiencies of the prior art, the present invention broadly provides, systems for monitoring and controlling operating modes in a network transceiver as well as methods of operating the same. A controller is introduced illustratively herein for use with an Ethernet transceiver, having both an encoder and a decoder. The controller is associated with the encoder and decoder and operates to control operating modes of the transceiver.

According to an exemplary embodiment, the controller comprises both an encoder portion and a decoder portion. The encoder portion is operable to direct the encoder to encode data in one of an industry-compliant mode and a custom mode. The decoder portion is operable, in response to sensing data received in custom mode at the decoder, to direct: (i) the decoder to decode the received data in custom mode, and (ii) the encoder portion to direct the encoder to encode data in custom mode. In a preferred embodiment, the industry-compliant mode is compliant with IEEE 802.3ab, an Ethernet standard.

In a related embodiment, the controller further comprises a reset portion that is operable to reset the operating mode of the transceiver to industry-compliant mode. Advantageously, the reset

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portion may be associated with the decoder portion and operate to direct both the decoder and encoder portions to direct respectively, the decoder to decode the received data in industry-compliant mode and the encoder to encode data in industry-compliant mode.

According to an advantageous embodiment, the principles hereof are implemented in a computer system for association with an Ethernet network. The computer system comprises a processing unit, a memory that is associated with the processing unit, and an Ethernet transceiver. The Ethernet transceiver, which is associated with each of the processing unit and the memory, associates the computer system with the Ethernet network.

The Ethernet transceiver comprises an encoder, a decoder and a controller. The encoder encodes data to be transmitted by the Ethernet transceiver over the Ethernet network. The decoder decodes data received by the Ethernet transceiver over the Ethernet network. The controller, which is associated with the decoder and the encoder, controls operating modes of the Ethernet transceiver and is operable to (i) negotiate a communications channel between the computer system and another computer system associated with the Ethernet network, the computer system entering one of a master state and a slave state, (ii) direct, in response to

entering the master state, the encoder to encode data to be
transmitted to the another computer in an industry-compliant mode
and, if the encoded data is not properly received by the another
computer, to encode data to be transmitted to the another computer

5   in a custom mode, (iii) direct, in response to entering the slave
state, the decoder to decode data received from the another
computer in the industry-compliant mode and, if the received data
cannot properly be decoded, to decode the received data in the
custom mode.

10   According to an alternate advantageous embodiment of the
Ethernet transceiver, the controller is operable to (i) negotiate
a communications channel between the computer system and another
computer system associated with the Ethernet network, the computer
system entering one of a master state and a slave state,

15   (ii) direct, in response to entering the master state, the
encoder to encode data to be transmitted to the another computer in
a custom mode and, if the encoded data is not properly received by
the another computer, to encode data to be transmitted to the
another computer in an industry-compliant mode, and (iii) direct,

20   in response to entering the slave state, the decoder to decode data
received from the another computer in the custom mode and, if the
received data cannot properly be decoded, to decode the received

data in the industry-compliant mode.

According to yet another alternate advantageous embodiment of the Ethernet transceiver, the controller is operable to (i) negotiate a communications channel between the computer system and another computer system associated with the Ethernet network, the computer system entering one of a master state and a slave state, and (ii) repeatedly directs, in response to entering one of the master state and the slave state, the encoder to encode data to be transmitted to the another computer in one of an industry-compliant mode and a custom mode until the encoded data is properly received by the another computer.

The foregoing has outlined rather broadly the features and technical advantages of the present invention so that those skilled in the art may better understand the DETAILED DESCRIPTION OF THE INVENTION that follows. Additional features and advantages of the invention will be described hereinafter that form the subject of the claims of the invention. Those skilled in the art should appreciate that they may readily use the conception and specific embodiments disclosed as a basis for modifying or designing other structures for carrying out the same purposes of the present invention. Those skilled in the art should also realize that such equivalent constructions do not depart from the spirit and scope of the

invention in its broadest form.

Before undertaking the DETAILED DESCRIPTION OF THE INVENTION, it may be advantageous to set forth definitions of certain words and phrases used throughout this patent document: the terms "include" and "comprise," as well as derivatives thereof, mean inclusion without limitation; the term "or," is inclusive, meaning and/or; the phrases "associated with" and "associated therewith," as well as derivatives thereof, and the term "associable" may mean to include, be included within, interconnect with, contain, be contained within, connect to or with, couple to or with, be communicable with, cooperate with, interleave, juxtapose, be proximate to, be bound to or with, have, have a property of, or the like; and the terms "controller" and "processor" mean any device, system or part thereof that controls at least one operation, such a device may be implemented in hardware, firmware or software, or some suitable combination of at least two of the same. It should be noted that the functionality associated with any particular controller/processor may be centralized or distributed, whether locally or remotely. Definitions for certain words and phrases are provided throughout this patent document, those of ordinary skill in the art should understand that in many, if not most instances, such definitions apply to prior, as well as future uses of such

defined words and phrases.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which like numbers designate like parts and in which:

FIGURE 1 illustrates a block diagram of an exemplary network transceiver that is operable to communicate in at least an industry-compliant mode and a custom mode, all in accord with the principles of the present invention;

FIGURE 2a illustrates a flow diagram of an exemplary method of operating the network transceiver of Figure 1 to communicate in a default industry compliant mode and to switch and communicate in a custom mode, all in accord with the principles of the present invention;

FIGURE 2b illustrates a flow diagram of an alternate exemplary method of operating the network transceiver of Figure 1 to communicate in a default custom mode and to switch and communicate in an industry compliant mode, all in accord with the principles of the present invention;

FIGURE 3 illustrates a block diagram of an exemplary embodiment of a computer system in association with an exemplary computer network that is capable of providing a suitable

environment within which the principles of the present invention may be implemented;

FIGURE 4 illustrates a flow diagram of an exemplary method of operating the computer system in association with computer network of Figure 3 to communicate in at least one of an industry-compliant mode and a custom mode, all in accord with the principles of the present invention; and

FIGURE 5 illustrates exemplary state diagrams implementing alternative monitor and control switch logic that may be associated with the embodiments of the network transceiver introduced with reference to FIGURES 1 to 4.

DETAILED DESCRIPTION

FIGURES 1 through 5, discussed below, and the various embodiments used to describe the principles of the present invention in this patent document are presented by way of illustration only and should not be construed to limit the scope of the invention in any manner. Those skilled in the art will understand that the principles of systems for monitoring and controlling the operating modes of a network transceiver, and methods of operating the same, set forth herein may be implemented in association with any suitably arranged processing system.

Referring initially to FIGURE 1, illustrated is a block diagram of an exemplary network transceiver 100, illustratively, an Ethernet transceiver, that is operable to communicate in at least an industry compliant mode (e.g., IEEE 802.3ab ("Gigabit Media Independent Interface")) and a custom mode, all in accord with the principles of the present invention. Exemplary Ethernet transceiver 100, also known as a medium access unit ("MAU"), actually applies signals onto an Ethernet network wire (not shown) and detects signals passing there through. According to the illustrated embodiment, Ethernet transceiver 100 may suitably be associated with a network interface card ("NIC"), which is described with reference to FIGURE 3.

Ethernet transceiver 100 illustratively includes receiver circuitry 110, a digital-to-analog converter ("DAC") 115, an encoder 120, a decoder 125 and a mode controller 130. Exemplary receiver circuitry 110 is operable to receive analog signals in at least industry-compliant and custom modes, and may suitably include conventional components such as a automatic gain control ("AGC"), an analog-to-digital converter, baseline-wander-correction circuitry, a feed-forward equalizer ("FFE"), a decision feedback equalizer ("DFE")/trellis decoder, echo/next canceller circuitry, timing/phase recovery circuitry, and the like. Added description of such conventional components is superfluous and will not be further undertaken in this patent document. It is nevertheless noted that Ethernet transceiver 100 is preferably a complete 10/100/1000 BASE-T solution operable to integrate circuitry necessary to provide 100/1000 BASE-T Ethernet on-a-chip, and to provide an interface to an external 10 BASE-T transceiver for 10/100/1000 BASE-T support.

Exemplary DAC 115 is operable to convert digital data signals into analog data signals. Exemplary encoder 120 is operable to encode data signals coded in a first format into a second format. Exemplary decoder 125 is operable to decode data signals coded in a first data format into a second data format. Exemplary mode

controller 130 is associated with encoder 120 and decoder 125, and operates to control the at least two operating modes of Ethernet transceiver 100.

Mode controller 130 illustratively includes both an encoder portion 135 and a decoder portion 140. Exemplary encoder portion 135 is operable to direct encoder 120 to encode data in at least one of industry-compliant mode or custom mode. Exemplary decoder portion 140 is similarly operable to direct decoder 125 to decode data received at Ethernet transceiver 100 in at least one of industry-compliant mode or custom mode. Additionally, according to the illustrated embodiment, decoder portion 140 is further operable, in response to sensing data received in custom mode at decoder 125, to direct (i) decoder 125 to decode the received data in custom mode and (ii) direct encoder portion 135 to direct encoder 125 to encode data in custom mode.

The principles hereof may advantageously be implemented in a computer system (shown with reference to FIGURE 3) for association with an Ethernet network. The Ethernet transceiver 100, which is associated with each of a processing unit and a memory, associates the computer system with the Ethernet network. Ethernet transceiver 100 comprises controller 130 that is associated with encoder 120 and decoder 125, is operable to (i) negotiate a

communications channel between the computer system and another

computer system associated with the Ethernet network, the computer

system entering one of a master state and a slave state, and

(ii) repeatedly directs, in response to entering one of the

5   master state and the slave state, encoder 120 to encode data to be

transmitted to the another computer in one of industry-compliant

mode and custom mode until the encoded data is properly received by

the another computer.

Referring next to FIGURE 2a, illustrated is a flow diagram of

10   an exemplary method of operating a network transceiver 100, such as

the Ethernet transceiver of Figure 1 (generally designated 200) to

communicate in a default industry-compliant mode and to switch and

communicate in at least a custom mode, all in accord with the

principles of the present invention. For purposes of illustration,

15   concurrent reference is made to exemplary Ethernet transceiver 100

introduced with reference to FIGURE 1.

Exemplary method 200 operates Ethernet transceiver 100 when

associated with a computer system that is associated with a

computer network (an exemplary computer system and computer network

20   are described with reference to FIGURE 3) to allow operating modes

of Ethernet transceiver 100 to be monitored and controlled. In one

preferred implementation, Ethernet transceiver 100 comprises a mode

controller 130 that repeatedly directs, in response to transceiver 100 entering a master state or a slave state, encoder 120 to encode data to be transmitted in industry-compliant mode or custom mode until the encoded data is properly received over the computer network.

5

To begin, Ethernet transceiver 100 uses encoder 120 and decoder 125 to respectively encode and decode data signals in a default industry-compliant mode (process step 210), which is compliant with IEEE 802.3ab according to the illustrated embodiment. Mode controller 130 operates to sense whether data received at decoder 125 is in at least one of industry-compliant mode and custom mode (process step 215). In the illustrated embodiment, Ethernet transceiver 100 operates in a default industry-compliant mode and mode controller 130 operates to sense whether data received at decoder 125 is in custom mode.

In response to sensing data received at decoder 125 in custom mode ("Y" branch of decision step 220), mode controller 130, and particularly, decoder portion 140 thereof, directs (i) decoder 125 to decode received data signals in custom mode, and (ii) encoder portion 135 to direct encoder 120 to encode data signals to be transmitted in custom mode; which collectively cause Ethernet transceiver 100 to use encoder 120 and decoder 125 to respectively

encode and decode data signals in custom mode (process step 225).

In the illustrated embodiment, Ethernet transceiver 100 continues

to operate in custom mode while mode controller 130 operates to

sense whether data received at decoder 125 is in industry-compliant

5   mode.

In response to sensing data received at decoder 125 in default

industry-compliant mode ("N" branch of decision step 230), mode

controller 130, and particularly, decoder portion 140 thereof,

resets the operating mode of Ethernet transceiver 100 to default

10   industry-compliant mode (process step 235).   In resetting the

operating mode of Ethernet transceiver 100, mode controller 130,

and again, decoder portion 140, directs (i) decoder 125 to decode

the received data signals in industry-compliant mode and

(ii) encoder portion 135 to direct encoder 120 to encode data

15   signals to be transmitted in industry-compliant mode; which

collectively cause Ethernet transceiver 100 to use encoder 120 and

decoder 125 to respectively encode and decode data signals in

default industry-compliant mode.

According to one implementation of the preferred embodiment

20   introduced here above, mode controller 130, in controlling

operating modes of Ethernet transceiver 100, negotiates a

communications channel between the computer system with which it is

associated and another computer system associated with the computer
network. Controller 130, in response thereto, enters into a
master state or a slave state, and directs:

- in response to entering the master state, encoder 120 to
5   encode data to be transmitted to the another computer in
          industry-compliant mode and then, if the encoded data is
          not properly received by the another computer, to encode
          data to be transmitted to the another computer in a
          custom mode, or

- in response to entering the slave state, decoder 125 to
10   decode data received from the another computer in the
          industry-compliant mode and then, if the received data
          cannot properly be decoded, to decode the received data
          in the custom mode.

Referring next to FIGURE 2b, illustrated is a flow diagram of
an alternate exemplary method of operating a network transceiver
100, again, such as the Ethernet transceiver of Figure 1 (generally
designated 205) to communicate in a default custom mode and to
switch and communicate in at least one industry-compliant mode, all
20   in accord with the principles of the present invention. Again, for
purposes of illustration, concurrent reference is made to exemplary
Ethernet transceiver 100 introduced with reference to FIGURE 1.

Exemplary method 205 operates Ethernet transceiver 100 when associated with a computer system that is associated with a computer network (both are described with reference to FIGURE 3) to allow operating modes of Ethernet transceiver 100 to be monitored

5   and controlled. Again, in one preferred implementation, Ethernet transceiver 100 comprises mode controller 130 that repeatedly directs, in response to transceiver 100 entering a master state or a slave state, encoder 120 to encode data to be transmitted in industry-compliant mode or custom mode until the encoded data is

10   properly received over the computer network.

To begin, Ethernet transceiver 100 uses encoder 120 and decoder 125 to respectively encode and decode data signals in a custom mode (process step 240). Mode controller 130 operates to sense whether data received at decoder 125 is in at least one of

15   industry-compliant mode and custom mode (process step 245). In the illustrated embodiment, Ethernet transceiver 100 operates in a custom mode and mode controller 130 operates to sense whether data received at decoder 125 is in industry-compliant mode, which is compliant with IEEE 802.3ab according to the illustrated

20   embodiment.

In response to sensing data received at decoder 125 in industry-compliant mode ("Y" branch of decision step 250), mode

controller 130, and particularly, decoder portion 140 thereof, directs (i) decoder 125 to decode received data signals in industry-compliant mode, and (ii) encoder portion 135 to direct encoder 120 to encode data signals to be transmitted in industry-

5   compliant mode; which collectively cause Ethernet transceiver 100 to use encoder 120 and decoder 125 to respectively encode and decode data signals in industry-compliant mode (process step 255). In the illustrated embodiment, Ethernet transceiver 100 continues to operate in industry-compliant mode while mode controller 130

10   operates to sense whether data received at decoder 125 is in custom mode.

In response to sensing data received at decoder 125 in default custom mode ("N" branch of decision step 260), mode controller 130, and particularly, decoder portion 140 thereof, resets the operating

15   mode of Ethernet transceiver 100 to default custom mode (process step 265). In resetting the operating mode of Ethernet transceiver 100, mode controller 130, and again, decoder portion 140, directs (i) decoder 125 to decode the received data signals in custom mode and (ii) encoder portion 135 to direct encoder 120 to encode data

20   signals to be transmitted in custom mode; which collectively cause Ethernet transceiver 100 to use encoder 120 and decoder 125 to respectively encode and decode data signals in default custom mode.

According to one implementation of the preferred embodiment introduced here above, mode controller 130, in controlling operating modes of Ethernet transceiver 100, negotiates a communications channel between the computer system with which it is

5   associated and another computer system associated with the computer network.   Controller 130, in response thereto, enters into a master state or a slave state, and directs:

• in response to entering the master state, encoder 120 to encode data to be transmitted to the another computer in

10   a custom mode and, if the encoded data is not properly received by the another computer, to encode data to be transmitted to the another computer in an industry-compliant mode, or

• in response to entering the slave state, decoder 125 to

15   decode data received from the another computer in the custom mode and, if the received data cannot properly be decoded, to decode the received data in the industry-compliant mode.

Referring next to FIGURE 3, illustrated is a block diagram of

20   an exemplary embodiment of a computer system (generally designated 300) in association with an exemplary Ethernet network 305. Exemplary computer system 300 is capable of providing a suitable

environment within which the principles of the present invention may be implemented. Again, for purposes of illustration, concurrent reference is made to Ethernet transceiver 100 introduced with reference to FIGURE 1, as well as the methods of operating

5   Ethernet transceiver 100 that were introduced with reference to FIGURES 2a and 2b.

Computer system 300 illustratively includes a display device, a keyboard, a mouse and speakers, which cooperatively facilitate communication between computer system 300 and a user (not shown).

10   Computer system 300 further includes a chassis 310 housing various electronic components comprising computer processing circuitry, illustratively including, a central processing unit ("CPU"), a system clock, a memory (which typically comprises volatile RAM memory, and a disk storage device (which typically comprises one or

15   more readable/writeable fixed storage devices, such as a hard-disk drive, a removable storage device (e.g., a floppy disk, a ZIP disk, a CD-ROM disk, a DVD disk, etc.), or the like). In addition to computer processing circuitry, computer system 300 also comprises peripheral device circuitry illustratively including a

20   mouse/keyboard controller, a video card, a sound card, and a peripheral card 315, such as a NIC.

Exemplary peripheral card 315 is operable to provide a

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communication interface associating computer system 300 with computer network 305 and to facilitate communication between computer system 300 and at least one of the plurality of other computer systems 320. According to the illustrated embodiment, Ethernet transceiver 100 is associated with peripheral card 315. Preferably, at least decoder portion 140 of mode controller 130 is embodied in peripheral card 315, and operates to allow computer system 300 to decode and process data received from at least one of other computer systems 320 via Ethernet network 305.

It should be noted that the computer processing circuitry and the peripheral device circuitry are associated via common bus circuitry 325, thereby associating peripheral card 315 with the CPU, the system clock, the memory and the storage device. Ethernet transceiver 100 is again associated with an encoder, decoder and a mode controller, such as those described illustratively with reference to the embodiments of FIGURES 1 to 2b. The mode controller (not shown), which need not be included within Ethernet transceiver 100, whether in whole or in part, again operates to control the operating modes thereof. The mode controller is operable, in response to sensing data received at the decoder, to direct respectively the decoder and the encoder to decode and encode received and transmitted data in industry-compliant mode or

custom mode.

Those skilled in the pertinent art will note that the principles of the present invention may be implemented in any suitable computer processing environment, whether micro, mini,

5   mainframe, super or like computers, including multi and parallel processing environments, as well as computer networks. To that end, conventional computer system architecture is more fully discussed in THE INDISPENSABLE PC HARDWARE BOOK, by Hans-Peter Messmer, Addison Wesley (2nd ed. 1995) and COMPUTER ORGANIZATION

10   AND ARCHITECTURE, by William Stallings, MacMillan Publishing Co. (3rd ed. 1993); conventional computer and communications network design is more fully discussed in DATA NETWORK DESIGN, by Darren L. Spohn, McGraw-Hill, Inc. (1993); conventional data communication is more fully discussed in VOICE AND DATA COMMUNICATIONS HANDBOOK, by

15   Bud Bates and Donald Gregory, McGraw-Hill, Inc. (1996); DATA COMMUNICATIONS PRINCIPLES, by R. D. Gitlin, J. F. Hayes and S. B. Weinstein, Plenum Press (1992); and THE IRWIN HANDBOOK OF TELECOMMUNICATIONS, by James Harry Green, Irwin Professional Publishing (2nd ed. 1992). Each of the foregoing publications is

20   incorporated herein by reference for all purposes, as if fully set forth herein.

Referring next to FIGURE 4, illustrated is a flow diagram of

an exemplary method of operating computer system 300 in association

with computer network 305 of Figure 3 (generally designated 400) to

communicate in at least one of an industry-compliant mode and a

custom mode, all in accord with the principles of the present

5   invention.   Again,   for   purposes   of   illustration,   concurrent

reference is made to the embodiments introduced with reference to

FIGURES 1 to 3.

Exemplary method 400 operates computer system 300 having a

network transceiver, such as Ethernet transceiver 100, to allow

10   operating modes of transceiver 100 to be monitored and controlled

for use in association with network 305.   As above-introduced, the

Ethernet   specification,   broadly   speaking,   is   a   LAN   protocol

advancing a bus or star topology that served as the basis for the

IEEE 802.3ab standard, which specifies the physical and lower

15   software layers.

According to the illustrated embodiment, computer system 300

executes ones of a plurality of programs stored in memory or disk

storage (process step 405; e.g., application programs, system

programs, etc.) while monitoring a network connection via NIC 315

20   and, particularly, Ethernet transceiver 100 (process step 410).

Upon a determination that data is present at encoder 120 for

transmission to one of the other computer systems 320 via network

305 ("Y" branch of decision step 415), Ethernet transceiver 100 (again, associated with NIC 315) instructs encoder 120 to encode such data in one of at least an industry-compliant mode and a custom mode (process step 420). According to the embodiments

5   introduced with reference to FIGURES 2a and 2b, one of these modes may suitably be designated a default mode, *i.e.*, an encoding mode used to encode data unless directed otherwise; alternatively, the immediately-past encoding mode may suitably be used as the default mode; or some hybrid combination of the same may be adopted. It

10 should be noted that in one advantageous embodiment, industry-compliant mode is a default mode; in another embodiment, custom mode is a default mode; and, in yet another embodiment, mode controller 130 has a default mode set to a most current (*e.g.*, a last used, etc.) decode mode.

Upon a determination that data is present at decoder 125 for receipt computer system 300 from one of the other computer systems 320 via network 305 ("Y" branch of decision step 425), Ethernet transceiver 100 via mode controller 100 directs decoder 125 to decode such received data in a selected one of the industry-

20 compliant mode or the custom mode, such selection made in response to the format of the received data, (process step 430) and directs encoder 120 to encode related, or otherwise subsequently

responsive, data in the same selected mode (process step 435). As above-introduced with reference to FIGURES 2a and 2b, one of these modes may suitably be designated a default mode, *i.e.*, a decoding mode used to decode data until data is sensed at decoder 125 in

5   another mode; alternatively, the immediately-past decoding mode may also suitably be used as the default mode; or some hybrid combination of the same may be adopted.

More particularly, computer system 300 comprises Ethernet transceiver 100, which is associated with each of the CPU and

10   memory, and operates generally to associate computer system 300 with Ethernet network 305. Ethernet transceiver 100 comprises an encoder, a decoder and a mode controller, wherein the mode controller controls the operating modes of Ethernet transceiver 100. In each of the three "default" embodiments, Ethernet

15   transceiver 100 operates to negotiate a communications channel between computer system 300 and another computer system 320a-320n associated with Ethernet network 305, causing computer system 300 to enter one of a master state or a slave state.

In the embodiment wherein the default mode is the

20   industry-compliant mode, mode controller 130 directs:

- in response to entering the master state, the encoder to encode data to be transmitted to another computer 320 in

an industry-compliant mode and, if the encoded data is
not properly received by another computer 320, to encode
data to be transmitted to another computer 320 in a
custom mode; the decoder to decode data in the format
accepted by another computer 320, and

• in response to entering the slave state, the decoder to
decode data received from another computer 320 in the
industry-compliant mode and, if the received data cannot
properly be decoded, to decode the received data in the
custom mode; the encoder to encode data in the format
accepted by another computer 320.

In the embodiment wherein the default mode is the custom mode,
mode controller 130 directs:

• in response to entering the master state, the encoder to
encode data to be transmitted to another computer 320 in
a custom mode and, if the encoded data is not properly
received by another computer 320, to encode data to be
transmitted to another computer 320 in an industry-
compliant mode; the decoder to decode data in the format
accepted by another computer 320, and

• in response to entering the slave state, the decoder to
decode data received from another computer 320 in the

custom mode and, if the received data cannot properly be decoded, to decode the received data in the industry-compliant mode; the encoder to encode data in the format accepted by another computer 320.

5   In another, regardless of the default mode, mode controller 130 repeatedly directs, in response to entering either the master state or the slave state, the encoder to encode data to be transmitted to the another computer in one of an industry-compliant mode and a custom mode until the encoded data is properly received

10   by the another computer; or the decoder to decode data received from another computer 320 in industry-compliant mode and custom mode until the decoded data is properly received by transceiver 100.

Referring finally to FIGURE 5, illustrated are exemplary state diagrams (generally designated 500 and 505) implementing alternate

15   monitor and control switch logic that may be associated with network transceivers implemented in accord with the principles of the present invention, such as Ethernet transceiver 100 introduced with reference to FIGURES 1 to 4. For purposes of illustration,

20   concurrent reference is made to FIGURES 1 to 4.

State machine 500 illustrates exemplary switch scenarios for encoder 120, decoder 125 and mode controller 130 implementing the

logic of the above-described Ethernet transceiver embodiments wherein industry-compliant mode is a default mode. The switch scenarios are initiated by sensing data received in one of an industry-compliant mode and at least one custom mode at decoder

5   125. According to this embodiment, mode controller 130, in combination with encoder 125 and decoder 130, monitors and controls the two or more operating modes of Ethernet transceiver 100. Mode controller 130 again comprises encoder portion 135 and decoder portion 140. Ethernet transceiver 100 operates in default

10   industry-compliant mode, whereas decoder portion 140 is operable, in response to sensing data received in custom mode at the decoder, to direct: (i) the decoder to decode the received data in custom mode, and (ii) the encoder portion to direct the encoder to encode data in custom mode. Upon a determination that the respective

15   custom-mode communication is complete, Ethernet transceiver resets to communicating data in default industry-compliant mode. This may suitably be accomplished by sensing data in industry-compliant mode at decoder 125 or otherwise.

Alternatively, state machine 505 illustrates exemplary switch

20   scenarios for encoder 120, decoder 125 and mode controller 130 implementing the logic of the above-described Ethernet transceiver embodiments wherein default mode changes over time is set to the

immediately-past operating mode. The switch scenarios are initiated by sensing data received in one of an industry-compliant mode and at least one custom mode at decoder 125. According to this embodiment, mode controller 130, in combination with encoder 125 and decoder 130, monitors and controls the two or more operating modes of Ethernet transceiver 100. Ethernet transceiver 100 operates in the immediately-past operating mode, whether in industry-compliant or other custom mode, and decoder portion 140 is operable, in response to sensing data received in a different operating mode at the decoder, to direct: (i) the decoder to decode the received data in the different operating mode, and (ii) the encoder portion to direct the encoder to encode data in the different operating mode.

Although the present invention has been described in detail, those skilled in the art should understand that they can make various changes, substitutions and alterations herein without departing from the spirit and scope of the invention in its broadest form.